Transferring Ownership of ModSAF Behavioral Attributes

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ABSTRACT: *This paper describes an innovative advanced distributed simulation (ADS) architecture that provides improved behavioral representation of STRICOM's Modular Semi-Automated Forces (ModSAF) entities without incorporating additional functionality within ModSAF. A significant shortcoming that has been identified by the ModSAF user community is the predictable nature of human/system performance. Currently, ModSAF entity performance does not vary or degrade as a function of battlefield conditions. In addition, as increased functionality has been placed within ModSAF, it has grown into an extremely complex development environment. The Realistic Entity AbiLity Simulation Suite (REALSS) presented here is an architecture that implements variable and degradable human/system performance for ModSAF entities by transferring the "ownership" of the entity performance attributes to an external server. The methodology uses a Micro Saint task network crew model linked with a set of taxonomic degradation functions to predict performance. Through DIS PDUs or HLA objects, attributes and interactions,, the REALSS provides ModSAF entity performance parameters resulting from nuclear prompt radiation, blast, chemical, and biological environments for the AH64, M1, M2, M3, M109, M577, and T72 vehicles. The SBCCOM/DTRA Nuclear, Chemical, Biological, and Radiological (NCBR) Simulator provides the environmental representation of nuclear events on the synthetic battlefield. A REAL Performance Server uses these environments to determine exposure and system performance for the ModSAF entities. ModSAF entities then behave in a manner on the battlefield that includes variable and degradable performance. This architecture also enables stealth visualization of the appropriate damage to vehicles from blast environments.*

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1. The Current State of ModSAF

Modular Semi Automated Forces (ModSAF) is an extensively developed, highly used, state-of-the-art computer generated forces (CGF) software application capable of representing performance aspects of synthetic battlefield entities. It has found great use in the training community for allowing force-on-force battles to be played with a minimal number of live or human-in-the-loop (HITL) simulators. ModSAF can autonomously represent the functionality of an entity or weapon system on the virtual battlefield. Entities maneuver, engage other entities (either HITL simulators or other CGFs), communicate, and perform various other functions. In essence, ModSAF provides basic representation of entities in most domains of interest for ADS.

The prevailing trend in the development and enhancement of ModSAF has been to implement new and advanced entity functionality within ModSAF. Numerous independent efforts aim at enhancing specific aspects of ModSAF to provide improved entity representation. Most of these efforts are aimed directly at incorporating specific and focused new functionality within ModSAF. This continuous modification process has become a dilemma for the ModSAF integrators and has created a highly complex product that has lost some of its agility. While ModSAF has evolved in a manner that has taken advantage of its current architecture, other possibilities to adding needed functionality also exist. One such technique involves transferring ownership of ModSAF attributes to an external server. This technique would expand the ModSAF architecture in a manner that could provide greatly enhanced entity representation without adding to an already complex ModSAF.

We hope that CGF programs such as OneSAF will review the concepts presented in this paper and evaluate the technologies and methodologies as a means to provide a significant advancement in the state of the art of CGF.

1.1. Current System/Human Performance Representation in ModSAF

The ModSAF user community has identified entity performance as an area requiring improved representation. There is a desire for improved weapon representation, entity decision-making behaviors, and system/human performance. System/human representation refers to entity performance appropriate for the environment in which it is operating. This means that entities perform tasks, functions, and actions representative of human or systems that have encountered similar situations and conditions.

An example that we will use in this paper to illustrate this point is one of an M1 tank crew engaging a target. ModSAF currently represents the behavior of an M1 tank crew through two parameters – the time to prepare a round and the time to engage a target and fire. These two tasks are represented in ModSAF as a load time and track time. ModSAF models the task time distribution of these two parameters, and all other system/human performance parameters, by using a lognormal distribution with a variable mean and a standard deviation that is fixed at half the mean in logarithmic space. With the exception of a training level nothing can vary these task times. This means that an M1 tank crew conducted sustained operations or performed under other battlefield stressors, such as exposure to toxic events, nuclear radiation, chemical agent attacks, or biological agent attacks, will continue to perform at the same level as a crew that has not encountered such real world stressors.

From a human factors standpoint, this provides a very static representation of system/human performance. Using such a standardized and limited method does not provide a robust environment for predicting system/human performance related to battlefield stress. The system/human performance entity representation that ModSAF currently provides is of a crew that is constantly well fed, well rested, and does not suffer any battlefield stress effects. While these ideal conditions could occasionally exist on a battlefield, crews typically encounter battlefield stressors that affect their ability to operate and perform their duties.

Describing the human performance representation deficiencies is one issue that is addressed here. A second issue involves the implementation of a method that implements a solution. There are issues hindering the actual implementation of additional entity functionality in ModSAF. A primary issue centers around the process of placing modifications into the STRICOM configuration controlled, or baseline, version of ModSAF. A non-trivial effort is required to integrate enhancements into the configuration control version of ModSAF. We have developed a method that both dramatically improves human/system performance representation and bypasses the restrictive configuration control process. That step in improving human representation is to transfer ownership of attributes such as system/human performance to an external server. Most importantly, transferring ownership will address complex modeling issues while mitigating the negative aspects of the configuration management of a large software application like ModSAF.

1.2 Capabilities for Improving Human Performance Representation

Government organizations and their contractor complements have developed various technologies and methodologies for improving entity realism. Two organizations at the forefront of these efforts are the Defense Threat Reduction Agency (DTRA, formerly the Defense Special Weapons Agency) and the Solider and Biological Chemical Command (SBCCOM). Issues that these agencies must deal with are highly complex and require expertise in many different technology areas in order to model and determine the effects from devices such as weapons of mass destruction (WMD).

DTRA and SBCCOM have developed technologies enabling modeling and propagation of environmental hazards on the synthetic battlefield. While many of these technologies relate to WMD issues, they can be extended or applied to other areas as well. What DTRA and SBCCOM have developed are WMD environment simulators that can propagate disturbed environments and contamination areas. They have also provided the capability to overlay these environments on systems and humans to appropriately degrade their ability to operate.

DTRA also has sponsored work to incorporate system/human performance enhancements into the ModSAF environment. Under a contract to DTRA, Micro Analysis & Design, Inc. concluded a proof-of-principle effort to incorporate advanced system/human effects into ModSAF. MA&D embedded realistic human performance representation in a single instance of ModSAF.

In the effort presented here, instead of implementing the changes directly in ModSAF, we move the variable and degradable system/human performance representation to an external server dedicated to that purpose. The implementation of a dedicated server external to ModSAF effectively transfers ownership of these attributes to the external server.

2. Realistic Entity AbiLity Simulation Suite (REALSS)

The Realistic Entity AbiLity Simulation Suite (REALSS) is a simulation architecture that provides the capability to use a dedicated external performance server to incorporate nuclear effects on systems and humans into ModSAF (or, potentially other CGF simulations). The REALSS consists of four systems that provide representation of nuclear events and the associated effects on ModSAF entities. The four systems are as follows: the Nuclear, Biological, Chemical, and Radiological (NCBR) Simulator, REAL Performance Server, REAL ModSAF, and MäK Technologies' Stealth. The effects upon an entity's ability to perform tasks or actions result from the impact of prompt and/or protracted radiation from a nuclear event and also the primary blast impact.

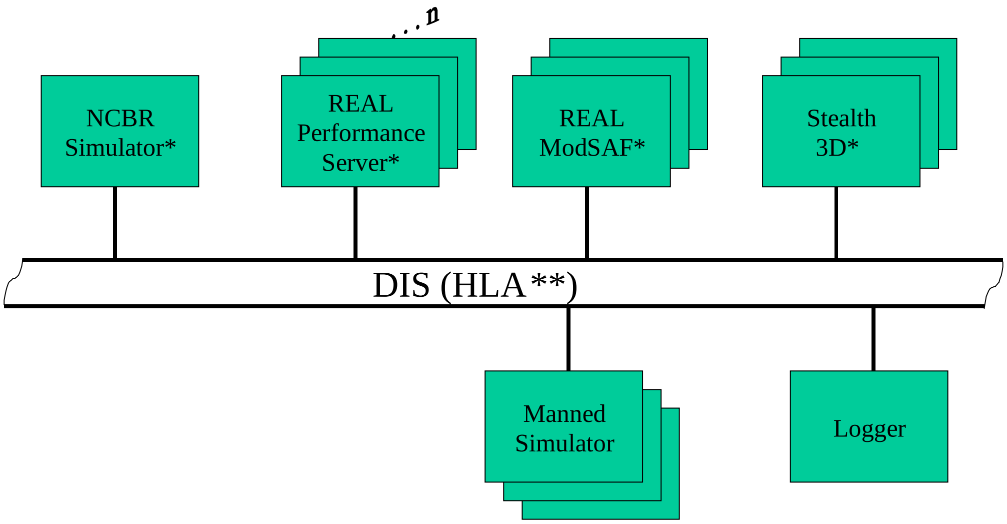
The purpose of the REALSS effort is to provide CGFs on the synthetic battlefield a realistic representation of human performance degradation and equipment damage resulting from human and system exposure to nuclear environments, specifically nuclear blast and radiation. Prior to this, representation of human performance and entity component damage in CGFs was deficient. There was no capability to determine or modify entity performance and appearance based upon these battlefield conditions or stressors. The REALSS provides the capability to both manually and automatically apply stressors and to alter entity performance and appearance based on that exposure. A link to an NCBR environment server provides propagation of the stressor on the synthetic battlefield. This exposure to stressors results in an appropriate degradation of entity performance and change in entity appearance. A stealth viewer provides a 3D view of the appearance of an affected entity.

The following paragraphs will discuss the overall architecture of the REALSS along with a discussion of each of the four systems identified above.

2.1 REAL Simulation Suite Architecture Overview

The REALSS is actually a federation of disparate simulations. These simulations, initially developed under different programs, are linked together to accomplish an overall objective of providing an architecture that allows nuclear environments to impact entity performance. It should be noted that while the underlying architecture for the REALSS is to incorporate WMD effects into ADS, the same technologies and methodologies can be used to incorporate other effects that will impact a ModSAF entities' ability to perform actions. Also, while ModSAF was the CGF of interest for this effort, these technologies and methodologies can be incorporated into other CGF systems such as Close Combat Tactical Trainer (CCTT-SAF).

Figure 2.1-1 shows the REALSS architecture. In the figure, the modules shown above the DIS/HLA network bus are part of the REALSS. Each of the modules communicates and sends data using DIS protocol data units (PDUs) or HLA objects, attributes, and interactions. The NCBR Simulator provides the capability to propagate prompt radiation, protracted radiation (fallout fields), and blast environments resulting from a nuclear event.



* REAL SS component under DTRA contracts (DSWA01-96-C-0173 & DSWA01-97-C-0109)
**High Level Architecture under DTRA WILCO contract (DSAW01-D-0084)

Figure 2.1-1. The REALSS architecture.

The REAL Performance Server determines entity exposure to nuclear environments, the impact on an entity's ability to perform actions, and "serves" these data to ModSAF entities. (A basic premise is that a ModSAF entity will only be served by a single REAL Performance Server.)

Also part of the REALSS is the REAL ModSAF. It is a slightly modified version of ModSAF that allows transfer of attribute ownership to an external server (a REAL Performance Server in this case). The ModSAF operator will retain the ability to use the basic performance capabilities supplied in the baseline version of ModSAF, but he will also have the ability to let ModSAF obtain realistic system/human performance descriptions from the REAL Performance Server. Under a program sponsored by the DTRA, six vehicle types are enabled with REALSS capabilities and are known as REAL ModSAF entities. These include the AH64 helicopter, M1 tank, M2 and M3 armored personnel carriers, M109 howitzer, M557 command and control vehicle, and the T72 tank. If these entities are exposed to nuclear radiation or blast environments, their performance and appearance will be altered appropriately.

The fourth module that constitutes the REALSS is the stealth. The stealth will provide for a three-dimensional visualization of the entity. Visualization will include the appropriate damage resulting from a blast environment.

2.2 Transferring Attribute Ownership – The Subscription Process

A subscription process is used by the REALSS to perform the transfer of ownership from ModSAF to a REAL Performance Server. When REAL ModSAF entities are created a process to subscribe to a REAL Performance Server. The sequence involves a handshake protocol that ensures that a link is established between an entity and a performance server.

The subscription process is depicted in Figure 2.2-1. In DIS, a REAL ModSAF entity initiates the subscription process by having ModSAF send an Action Request PDU requesting service from a REAL Performance Server. If available, a REAL Performance Server will reply with an Action Response PDU acknowledging that it can serve performance data to the entity. Due to the fact that the REALSS is built on a scaleable architecture and multiple REAL Performance Servers could provide such data, multiple REAL Performance Servers may respond to the request. REAL ModSAF will arbitrate the responses and selects a specific REAL Performance Server by replying with an Action Request PDU. Along with the reply, the REAL ModSAF entity will send initialization data concerning prior environmental conditions the entity has encountered. The selected REAL Performance Server then acknowledges the reply and begins to provide operational performance and appearance parameters to the REAL ModSAF entity.

This subscription process effectively transfers ownership of the REAL ModSAF entity's operational and visual appearance parameters to a REAL Performance Server. This architecture is scalable and allows for any number of REAL Performance Servers to be present.

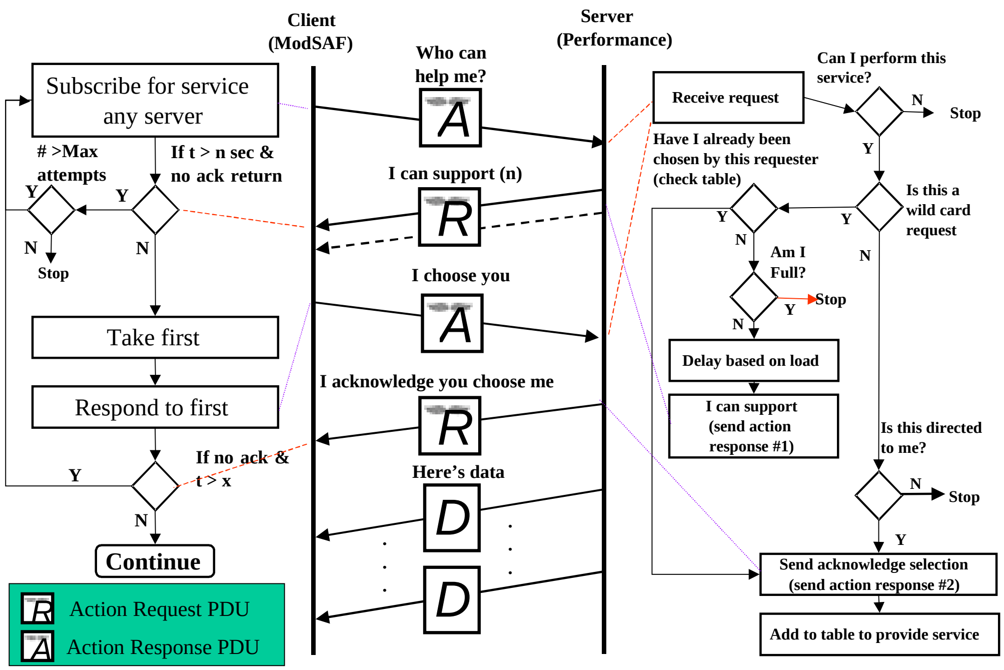


Figure 2.2-1. The REALSS subscription process for transferring attribute ownership from a client to a server.

2.3 NCBR Environment Simulator

The environment server that the REALSS will interact with is the NCBR Simulator. The modeling and simulation (M&S) community uses the NCBR Simulator throughout all phases of the Department of Defense (DoD) acquisition process, and a consortium of government agencies known as the "CBR Consortium" supports the continued development of the NCBR Simulator.

The NCBR Simulator provides simulated environments for prompt and persistent nuclear weapons, and chemical, biological, and radiological (CBR) events. It provides real-time transport and dispersion of CBR agents over complex (3D) terrain with complex time-varying meteorological inputs. It also provides prompt and persistent nuclear environments to other simulations on the network. The NCBR Simulator publishes 2D and 3D data to the network at specified intervals associated with each event. The simulator has the ability to handle multiple simultaneous agent events.

To calculate entity exposure to nuclear detonation events, the NCBR Simulator utilizes the DTRA Atmospheric Transport of Radiation (ATRv6) model. Calculating radiation fallout due to a nuclear detonation is modeled by NEWFALL (a code component incorporated into the DTRA NBC Hazard Prediction Assessment Capability (HPAC) system. Also contained in the NCBR Simulator is the XBLAST module from the MOving Receiver Environment Program version 4.0 (MORE 4.0) model. It provides the peak overpressure, peak dynamic pressure (wind), impulse, and positive phase duration data associated with blast effects from a nuclear burst.

For chemical and biological (CB) environments the NBCR Simulator can use Naval Surface Warfare Center's (NSWC's) Vapor Solid Liquid Tracking (VLSTRACK) or DTRA's Second-order Closure Integrated Puff (SCIPUFF) with the SWIFT meteorological model. This implementation allows the user to select the hazard dispersion engine and associated meteorological model for the exercise/application. Three-dimensional wind fields are provided to VLSTRACK from the Wind Over Critical Streamlined Surfaces (WOCSS) mass consistent flow model. Both models use a common representation of complex terrain that is based on National Imagery and Mapping Agency (NIMA) products and is compatible with the formats of the Synthetic Environment Data Representation & Interchange Specification (SEDRIS) program.

2.4 REAL Performance Server

The REAL Performance Server tracks subscribed ModSAF entities and provides visual damage and operational performance to these entities to properly represent the effects of a nuclear event on the synthetic battlefield.

The act of a ModSAF entity subscribing to a performance server transfers the ownership of the appropriate attribute from ModSAF to the REAL Performance Server. This subscription process causes the REAL Performance Server to begin tracking the subscribed entity. It records entity tracking information including its type and any pre-exposure to nuclear environments. The REAL Performance Server then provides appearance and operational performance parameters to the subscribed entity. The REAL Performance Server also "listens" on the DIS/HLA network for nuclear environment information generated by the NCBR Simulator. Upon receiving updated environmental exposure the appropriate environmental exposure fields of the entity-tracking table are updated. This exposure information is used to determine entity damage, if any, to subsystems as a result of the nuclear blast and also the human performance degradation effects resulting from radiation or blast exposure. The exposure information and any subsystem damage are then used to determine the performance of the entity for selected operational parameters. The appearance and operational parameters are sent to the REAL ModSAF entity.

2.5 REAL ModSAF

The REALSS utilizes a REAL version of ModSAF. As part of the REALSS effort, ModSAF code has been modified to portray effects of nuclear environments on entity performance. In REAL ModSAF, the entity types identified in section 2.1 can be affected by exposure to nuclear environments.

The user of REAL ModSAF has the ability to manually provide nuclear environment pre-exposure information to develop scenarios containing a nuclear exposure history. This capability eliminates the necessity of a long simulation run to develop a scenario containing long-term effects from exposure to nuclear environments. The REAL ModSAF entity accepts system component damage, appearance, and performance parameters from the REAL Performance Server. These parameters are used by ModSAF to represent visually and operationally REAL ModSAF entities exposed to nuclear environments. Parameters describing the component damage and appearance state of REAL ModSAF entities will be sent via the DIS/HLA network for stealth 3D visualization.

2.6 Stealth

The REALSS allows visual representation of the effects on REAL ModSAF entities from nuclear blast environments. The entity appearance data is obtained from Entity State PDUs generated by ModSAF. Figure 2.6-1 shows an example of the visualization of an M1 tank that has been subjected to a nuclear blast. Damage included in this scenario consists of a broken antenna and a track that has been knocked off due to the blast.

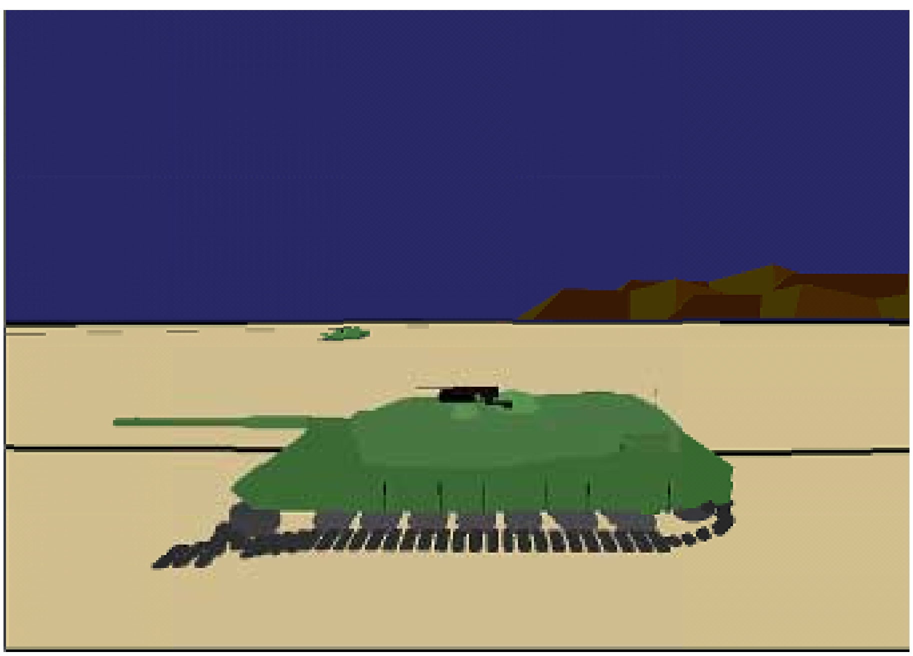


Figure 2.6-1. 3D visualization of an M1 tank subjected to a nuclear blast.

3. Environment Representation

The NCBR's original mechanism for sharing hazard data with other simulations used DIS Simulation Management (SIMAN) PDUs. A simulation would subscribe to the NCBR Simulator to specify the data it required (*e.g.*, concentration, rate of update, total dose). This approach worked well for relatively small numbers of entities and models of *point* chemical and biological sensors. However, because the NCBR was designed to track all of the entities in a given exercise, there was a limit to the number of entities that could be processed. This made it difficult to scale the NCBR for large exercises.

The addition of the Environmental Process and Gridded Data PDUs provided an opportunity to share the complete hazard environment (*vs*. at a point) with other simulations. Both PDUs support passing information on environmental phenomena. The Environmental Process PDU describes the hazard (or other phenomenon) as a geometry and a state. The Gridded Data PDU describes the hazard as a series of points. The NCBR uses both PDUs to publish the hazard environment.

3.1 Prompt Radiation

The NCBR publishes the prompt radiation environment once per nuclear event. Because the prompt radiation environment cannot be represented as a series of geometries, a Gridded Data PDU is used for publishing this environment. Prompt radiation exposure is specified horizontally every 50 meters until the exposure is less than 0.05 cGy. The current vertical spacing is every 100 meters up to 5000 meters. If the 0.05 cGy threshold is met at 5 kilometers, the required 3D grid will have 2,000,000 points. Sending this data via gridded data PDUs would require over 8,000 PDUs. This approach is impractical. Instead, the NCBR takes advantage of a first order assumption that a prompt radiation hazard can be represented as symmetric about the location of the detonation. Thus, the NCBR publishes a single 2D vertical grid with the origin at the location of the detonation projected to the ground. The receiver of the data rotates the grid about the origin to create an axis-symmetric geometry (*e.g.,* cylinder). For the same case as described above only 5,000 points are required. For ease of processing, the NCBR sends out the grid as a series of vertical vectors.

3.2 Protracted Radiation Environments

The NCBR uses NEWFALL to generate protracted radiation hazard environments and represents them with a series of horizontal cylinders or discs. Environmental Process PDUs describe these cylinders. Each Environmental Process PDU contains a bounding volume that contains all of the cylinders in the PDU. The NCBR continues to propagate the protracted radiation environment until the cloud dissipates. To reduce network impact, the NCBR spreads the number of PDUs required for single cloud over a 15-second interval. This is viable because the geometry records for each cylinder contain the information required to dead-reckon the cylinders.

3.3 Blast Environments

The blast environment can also be assumed as symmetric about the detonation point. Thus, the NCBR publishes it in a manner similar to the prompt radiation hazard. Whereas the prompt radiation hazard is a single value per grid point, the blast environment requires several values. Because there are different requirements for data at and above ground level, two different approaches are used to publish the blast environment.

At ground level the NCBR publishes six values: peak overpressure, overpressure total impulse, peak dynamic pressure, dynamic pressure total impulse, overpressure positive phase duration, and dynamic pressure positive phase. For points above the ground the NCBR publishes two values: peak overpressure and peak dynamic pressure. The horizontal spacing required for the blast is 50 meters until the peak overpressure is less than 3 psi.

Ground level data are sent as a vector parallel to the ground with a vector dimension of six. Depending on the size of the blast, more than one PDU may be required. The above ground level data are sent as vertical vectors similar to the prompt radiation. These PDUs have a vector dimension of two.

4. Human Performance Representation

This section details the methodology used to predict human performance degradation. The results of applying the methodology provide the basis for the REAL Performance Server to "serve" entity performance data to ModSAF. DTRA has managed efforts to develop models capable of predicting human response to nuclear environments for over 15 years. This work has formed the basis for the human performance prediction methodology used to determine the effects of nuclear environments called the Task-Taxon-Task (T3) methodology. The following two subsections provide insight into the makeup of the methodology and how the methodology is applied to crew models to predict human performance.

4.1 Task-Taxon-Task (T3) Methodology

The T3 methodology developed for crew performance degradation consists of three major parts. These parts are

1) a taxonomy for classifying tasks according to basic human skills, 2) a set of taxonomic degradation functions that that allow tasks to be degraded, and 3) task networks models developed in Micro Saint® for different weapon systems. The taxonomy is the mechanism that links performance degradation data gathered on one set of tasks or weapon systems to an infinite set of other tasks, including other weapon systems. Using a taxonomy such as this, we can save time and effort by only collecting data on a relatively small number of tasks and yet us it for a large variety of tasks. Through the taxonomy, we can relate these data to other seemingly unrelated tasks.

The basic premise behind the taxonomy is that tasks soldiers perform can be broken down into basic human skills or atomic tasks (Roth, 1992). These skill abilities are the basic skills required to perform a task. The taxonomy developed consists of five skills. The skills are attention, perception, psychomotor, physical, and cognitive. While it is possible and even likely that these abilities are not the only skills involved in performing tasks, they cover the majority of skills required to perform a military operational task. In determining the abilities required, it was important to select skills used in most tasks, yet not have an inordinate number such that a user of the methodology would have a cumbersome time using it. The five skills cover a majority of tasks, and yet are a manageable number for an analyst to use.

Also part of the taxonomy is a seven-point rating scale that is used to rate the demand for each ability as it relates to a task. A low score on an ability means that there is little or no demand on that ability for the specified task. A high score means that there is a high demand on the ability. This taxonomy is used in both the data collection and performance prediction portions.

A questionnaire approach is the primary vehicle used to gather data on how performance is degraded based on a stressor. This approach is used because many of the stressors or insults of interest can not be studied under real conditions for health and safety reasons. This approach is one that has been used previously to study radiation effects on soldiers (Glickman, 1983; Anno, Wilson, and Dore, 1983). Basically, the approach starts by administering a questionnaire to subject matter experts (SME). The SMEs make performance estimates for a set of skills based on a given set of physiological symptoms under which the tasks must be performed. The ratings the SME supplies are estimates of how long the stated tasks will take given the symptom complex on the page. The SME has the option of either stating that there will be no time increase for the task, supplying a time increase, or he can state that the task cannot be accomplished under the given physiological conditions. The SME also relates his confidence in his ability to rate the tasks as they relate to the given symptom complex. This provides the data required to determine performance degradation without health or safety hazard exposure risk.

After the data are gathered from the questionnaires two regressions are performed on the data to develop the degradation functions. The first regression maps the task performance decrement to dose level and time since exposure. The second regression maps the performance decrement to the taxonomic abilities based on the dose and time since exposure. Once completed, degradation functions per taxon ability are developed. MA&D has have developed degradation functions for each taxon as a function of nuclear radiation, nerve agent, mustard agent, and mission oriented protective posture (MOPP). For the REALSS, only the effects of nuclear radiation and primary blast are currently available.

4.2 Human Performance Modeling

With the completion of the taxonomy and the degradation functions we have the two tools needed to reflect stressor induced performance degradation in the crew models. The crew models were developed in the simulation language Micro Saint®, an event-driven simulation tool that allows crew tasks to be modeled at the required level of detail. Each action or task, either by a crewmember or by the weapon system, is modeled so that the events and actions to perform tasks are accomplished in a sequence that reflects real life.

Once the desired crew tasks and their sequence are modeled, the tasks that are performed by the crew must be weighted according to the ability taxonomy. Using the same rating scale that was used in the data collection effort, all of the tasks are rated according to the taxonomic abilities. After the tasks are rated, they are normalized and placed in the models. The degradation functions are then added to the models, and are run to get predictions on crew performance degradation for new tasks (LaVine, Peters, Laughery 1996).

The task flow in Figure 4.2-1 shows the actions that an M1 tank crew would perform in order to engage a target. The task flow shows two different paths through the network. The top path represents a fully capable M1 tank. The bottom path is for an M1 tank with either an inoperative laser rangefinder and/or gunner's primary sight. The performance resulting from the two paths are reflected in the differing performance times of Figure 4.2-2.

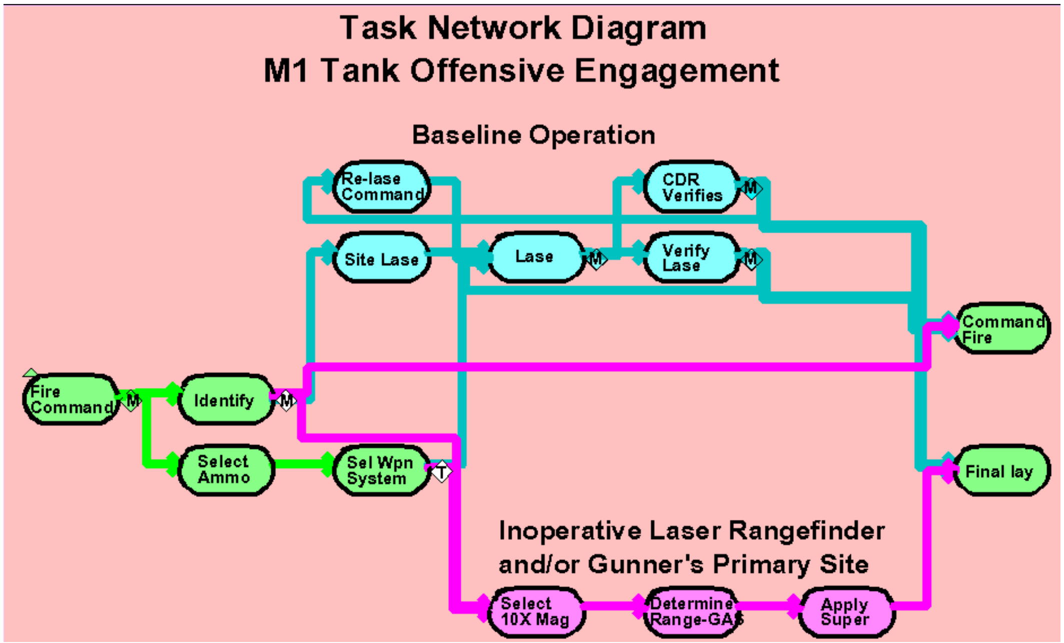


Figure 4.2-1. Task network diagram of an M1 tank offensive engagement.

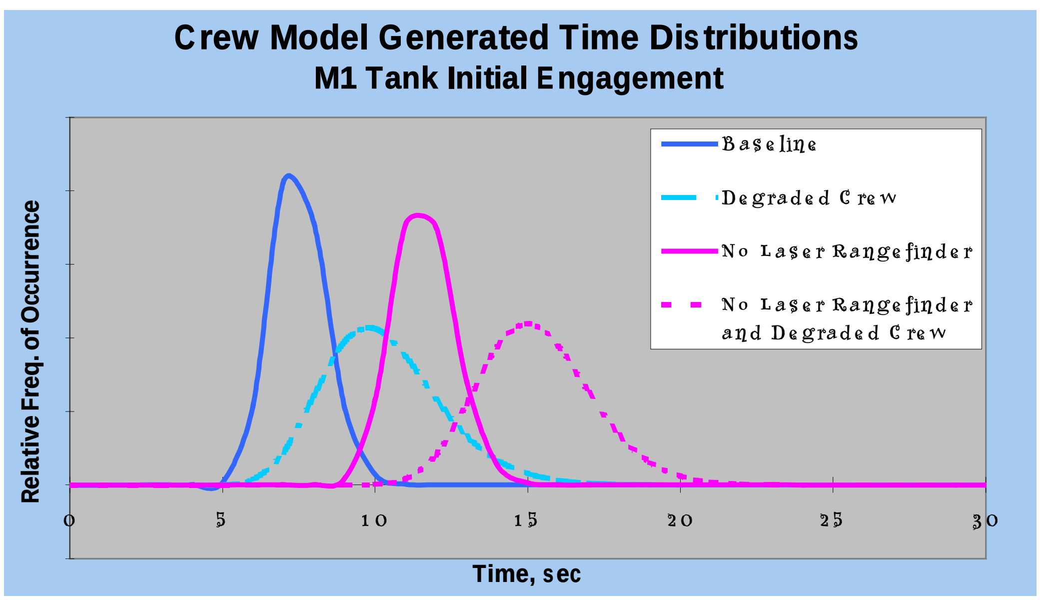


Figure 4.1-1. M1 tank crew degradation times as determined by Micro Saint models using the T3 methodology.

5. Future Plans

The REALSS and its architecture have the potential to be used for other CGF systems. We think it would be beneficial for the DoD to review and exploit the architecture for other system/human performance effects and for other services. The methodologies used in the REALSS can also be applied to applications serving sensor data to ModSAF entities. In addition, the REALSS can be configured to perform in HLA environments.

5.1 Migration to HLA

We designed the initial version of the REALSS to be DIS compliant. DTRA has already funded the migration of the REALSS from DIS to HLA under the ITT WILCO contract DSWA01-98-C-0084. DTRA's WILCO effort is an Agency-wide initiative that will bring DTRA physics-based weapons effects models into compliance with the HLA. By the time this paper is presented, the majority of the model development work will have been accomplished and integration of the disparate simulations will be occurring. Our approach to migrating this simulation suite to HLA will leverage the functionality already provided by the Real-time Platform Reference Federation Object Model (RPR FOM). We are active in Simulation Interoperability Standards Organization's (SISO's) standards development activities and will work to ensure that the RPR FOM is extended to accommodate the objects, attributes, and interactions associated with the REALSS if needed.

5.2 Application to Simulation-Based Acquisition

Due to the scalability of the REALSS architecture, the approach has applicability to the complete acquisition lifecycle—including R&D, test and evaluation, training, and analysis. Its real-time capabilities give it the flexibility to provide training to operators in the loop.

6. Summary and Conclusions

The REALSS demonstrates that transferring attribute ownership from ModSAF to an external server is a viable method. We have demonstrated that there are significant benefits to using this technology including representing entities in much greater detail than is practically feasible in ModSAF. Using the technologies and methodologies of the REALSS mitigates many of the issues associated with incorporating changes directly into ModSAF including increased complexity, code base size, and reduced system performance. Transferring ownership of system/human performance to a specialized performance server provides substantially improved modeling capabilities and fidelity, scalability, and a generic method to expand the capabilities of a CGF such as ModSAF without making continued intrusions into ModSAF and the Configuration Control Board.

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Author Biographies

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